REMARKS

The Examiner is thanked for the performance of a thorough search.

I. STATUS OF CLAIMS

Claims 16, 28, 29, and 30 have been amended. Claim 18 has been canceled. No claims have been added. Hence, Claims 16, 19-26, 28-30, and 32-49 are currently pending in the application.

II. REJECTIONS NOT BASED ON THE CITED ART

Claims 38 and 39 have been rejected as allegedly indefinite under 35 U.S.C. § 112, second paragraph. Claims 38 and 39 have been amended to provide for proper antecedent basis. Reconsideration and withdrawal of these rejections are respectfully requested.

III. REJECTIONS BASED ON THE CITED ART

A. INDEPENDENT CLAIM 16

Independent Claim 16 has been rejected under 35 U.S.C. § 103(a) as allegedly unpatentable over Venkatachary et al., U.S. Patent No. 6,212,184 ("VENKATACHARY") in view of Douceur et al., U.S. Patent No. 6,041,053 ("DOUCEUR").

Among other features, Claim 16 includes:

> ...
> looking up information in the header of said data packet in an expanded M-trie data structure, wherein **said expanded M-trie data structure** is organized as a multi-level tree including a root node, inferior nodes, and terminal nodes, **wherein each node stores values for an address and an opcode**, wherein **said opcode specifies:**
> **a particular field of a plurality of fields in the header of said data packet; and**
> **an operation that is to be performed on the data stored in said particular field**;
> ...

VENKATACHARY and DOUCEUR, when taken alone or in combination, do not describe the above feature of Claim 16 of an M-trie data structure organized as a tree with a root node, inferior nodes, and terminal nodes, where each node stores values for an address and an opcode, where the opcode specifies: a particular field of a plurality of fields in the header of a data packet, and an operation that is to be performed on the data stored in the particular field.

The Office Action asserts that this feature of Claim 16 is described in VENKATACHARY, in col. 10, lines 6-18, col. 14, lines 37-40, and col. 16, lines 10-33. Specifically, the Office Action asserts that the destination trie pointers PT1, PT2, PT3, and PT4 and/or the switch pointers SP1, SP2, SP3, and SP4 to the source tries correspond to the opcode featured in Claim 16. This is incorrect.

In general, VENKATACHARY describes a method for Layer 4 switching (e.g. switching at the Transport Protocol Layer). The Layer 4 switching is based on a set of routing filters. A grid of tries, which are binary branching trees, is constructed from the set of routing filters. (VENKATACHARY, Abstract.) Specifically, VENKATACHARY states that the combination of several header fields, such as destination address, source address, and application port numbers is called a filter. (Col. 5, lines 29-32.) "The filter database of a Layer 4 Router consists of a finite set of filters F_1, F_2, ... F_N. Each filter is a combination of K values, one for each header field." (Col. 8, lines 16-18.)

In VENKATACHARY, the combination of the fields for a particular filter are mapped to a grid of tries. The value of each field in the filter, such as a source or destination prefix in a packet header, is stored in one trie of the grid. VENKATACHARY defines a trie as "a binary branching tree with each branch labeled 0 or 1." (VENKATACHARY, col. 14, lines

30-31.) "**The prefix associated with a node u is the concatenation of all the bits from the root to the node u.**" (Col. 14, lines 31-33, emphasis added.) For example,

> FIG. 8 is a representation of this first embodiment, in which Dest-Trie is a trie for the destination prefixes. The **nodes corresponding to a valid destination prefix** in the database are shown as solid dots while others are shown as circles. **Each valid destination prefix has a pointer** (PT1, PT2, PT3, PT4) **to a trie containing the source prefixes that belong to filters having the corresponding destination prefix**. In FIG. 8, for instance, the leftmost node in the Dest-Trie has prefix value 00; the node on the right has value 10. Our basic data structure, called grid-of tries, is designed to handle two-dimensional filters, such as destination-source pairs. (Col. 14, lines 33-44, emphasis added.)

Further, VENKATACHARRY states in col. 15, lines 10-12, that the method of this first embodiment "matches the destination of the [packet] header in the Dest-Trie" to yield the longest match on the destination prefix. Thus, in VENKATACHARY an **entire** trie corresponds to one or more values of a destination or a source prefix. Moreover, any pointer, such as pointers PT1, PT2, etc., only **POINTS** to a trie containing source prefixes.

Significantly, nothing in VENKATACHARY suggests that a pointer, such as pointers PT1, PT2, etc., to a source trie somehow specifies a field in the header of a packet and an operation that is to be performed on data in that field. The pointers PT_i simply connect the destination tries and the source tries of a filter and perform no other functionality.

With respect to the SP_i pointers, VENKATACHARRY states in col. 16, lines 10-33, that:

> **The switch pointers SP1, SP2, SP3 and SP4 are shown [in FIG. 12] using dashed lines between source tries to distinguish the switch pointers from the dotted lines PT1, PT2, PT3 and PT4 that connect the Dest-Trie nodes to the corresponding source tries.**
> In order to understand the role of switch pointers such as SP1, SP2, SP3 and SP4, consider matching a packet with destination address 001 and source address 001. The search in the Dest-Trie gives D=00 as the best match. **So the search for the matching source prefix is started in the associated source trie, which contains filters F.sub.4 and F.sub.5.** However, the search immediately fails, since the first bit of the source is 0. According to the previous embodiment, we would back up along the Dest-Trie and restart the

> search in the source trie of D=0*, the parent of 00*.
> In this method embodiment, however, the switch pointer is used to directly jump to the node x in source trie containing {F.sub.1, F.sub.2, F.sub.3 }. **Similarly, when the search on the next bit of the source fails again, we jump to the node y of the third source trie (associated with the destination prefix *).** Intuitively, the switch pointers allow a jump directly to the lowest point in the ancestor source trie that has at least as good a source match as the current node. This allows the method to skip over all filters in the next ancestor source trie whose source fields are shorter than the current source match. This in turn improves the search complexity from O(W.sup.2) to O(W). (Emphasis added.)

The above passage shows that the SP_i pointers POINT from one node in the source tries to another node in the source tries. (In FIG. 12, the SP_i pointers are the dashed lines between nodes in the source tries). Thus, the only difference between the PT_i and SP_i pointers is that the PT_i pointers point from a node in the destination tries to a node in the source tries, while the SP_i pointers point from a node in the source tries to another node in the source tries. Apart from this difference, both the PT_i and SP_i pointers do nothing more than POINT to the next node at which the matching is to continue. Significantly, neither the PT_i pointers nor the SP_i pointers specify a field in the header of a packet and an operation that is to be performed on the data in that field, as featured in Claim 16.

With respect to the operation that allegedly is specified by the PT_i and/or SP_i pointers, the Office Action states in page 3, numbered paragraph 7, that the PT_i and/or SP_i pointers describe operations which "forward packet to particular link or to particular node in the source trie." This is incorrect.

As discussed above, the combination of a destination and source tries in VENKATACHARY represent a filter, where each trie represents the value of one or more fields that participate in the filter. The traversal of a particular trie is performed for the purpose of **matching** a search value to the values represented by that particular trie. (See, VENKATACHARY, col. 15, lines 10-18.) Thus, in VENKATACHARY it is **impossible** to

forward a packet TO a particular link or a particular node IN the source trie as the Office Action asserts.

For the above reasons, VENKATACHARY does not describe, teach, or suggest the feature of Claim 16 of an M-trie data structure organized as a tree with root, inferior, and terminal nodes, where each node stores the values for an address and an opcode, where the opcode specifies: a particular field of a plurality of fields in the header of a data packet, and an operation that is to be performed on the data stored in the particular field. Further, the Office Action does not assert and the Applicants cannot determine that DOUCEUR teaches, describes, or suggests this feature of Claim 16.

Since VENKATACHARY and DOUCEUR, when taken alone or in combination, do not describe, teach, or suggest all features of Claim 16, Claim 16 is patentable under 35 U.S.C. § 103(a) over VENKATACHARY in view of DOUCEUR. Reconsideration and withdrawal of the rejection are respectfully requested.

B. INDEPENDENT CLAIMS 28, 29, AND 30

Independent Claims 28, 29, and 30 have been rejected under 35 U.S.C. § 103(a) as allegedly unpatentable over VENKATACHARY in view of DOUCEUR.

Independent Claims 28, 29, and 30 include features similar to the features of Claim 16 discussed above. For this reason, Claims 28, 29, and 30 are patentable under 35 U.S.C. § 103(e) over VENKATACHARY in view of DOUCEUR for at least the reasons given above with respect to Claim 16. Reconsideration and withdrawal of the rejections are respectfully requested.

C. DEPENDENT CLAIMS 19-26 AND 32-49

Claims 19-20, 32-33, 40, and 45 have been rejected under 35 U.S.C. § 103(a) as allegedly unpatentable over VENKATACHARY in view of DOUCEUR. Claims 21-22, and

34-35 have been rejected under 35 U.S.C. § 103(a) as allegedly unpatentable over VENKATACHARY in view of DOUCEUR, and further in view of Chiu et al., U.S. Patent No. 6,385,170 ("CHIU"). Claims 23-24, 26, 36-37, and 39 have been rejected under 35 U.S.C. § 103(a) as allegedly unpatentable over VENKATACHARY in view of DOUCEUR, and further in view of Onishi et al., U.S. Patent No. 5,434,863 ("ONISHI"). Claims 25 and 38 have been rejected under 35 U.S.C. § 103(a) as allegedly unpatentable over VENKATACHARY in view of DOUCEUR, further in view of ONISHI, and further in view of CHIU. Claims 41-44, and 46-49 have been rejected under 35 U.S.C. § 103(a) as allegedly unpatentable over VENKATACHARY in view of DOUCEUR, and further in view of Wilford et al., U.S. Patent No. 5,509,006 ("WILFORD").

Each of Claims 19-26 and 32-49 depends from one of independent Claims 16, 29, and 30, and thus includes each and every feature of its corresponding independent claim. Furthermore, in rejecting Claims 19-26 and 32-49 the Office Action relies explicitly on VENKATACHARY and DOUCEUR, and not on any of the other references (CHIU, ONISHI, and WILFORD), to support prior disclosure of the features discussed above with respect to Claims 16, 29, and 30. Thus, since as shown above VENKATACHARY and DOUCEUR fail to teach all features of Claims 16, 29, and 30, any combination of VENKATACHARY and DOUCEUR with the other references necessarily fails to teach all features of dependent claims 19-26 and 32-49. Therefore, each of claims 19-26 and 32-49 is allowable for the reasons given above for Claims 16, 29 and 30. In addition, each of Claims 19-26 and 32-49 introduces one or more additional features that independently render it patentable. However, due to the fundamental differences already identified, to expedite the positive resolution of this case a separate discussion of those limitations is not included at this time. Therefore, it is

respectfully submitted that Claims 19-26 and 32-49 are allowable for the reasons given above with respect to Claims 16, 29, and 30.

IV. CONCLUSION

The Applicant believes that all issues raised in the Office Action have been addressed. Further, for the reasons set forth above, it is respectfully submitted that all of the pending claims are now in condition for allowance. Therefore, the issuance of a formal Notice of Allowance is believed next in order, and that action is most earnestly solicited.

The Examiner is respectfully requested to contact the undersigned by telephone if it is believed that such contact would further the examination of the present application.

To the extent necessary to make this reply timely filed, the Applicant petitions for an extension of time under 37 C.F.R. § 1.136.

If any applicable fee is missing or insufficient, throughout the pendency of this application, the Commissioner is hereby authorized to charge any applicable fees and to credit any overpayments to our Deposit Account No. 50-1302.

Respectfully submitted,
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